

REMARKS

Applicant respectfully requests consideration of the present application, as preliminarily amended.

Summary of Office Action

Claims 1-19 were noted as pending.

Claims 1-19 were rejected under 35 U.S.C. § 103 as being unpatentable over U.S. Patent No. 4,789,819 of Nelson ("Nelson") in view of U.S. Patent No. 5,359,236 of Giordano ("Giordano") and U.S. Patent No. 4,799,176 of Cacciatore ("Cacciatore").

Summary of Amendments

The specification has been amended at page 23, lines 16-17. Applicant respectfully submits that the specification was amended to properly refer to the temperature of the integrated circuit instead of the supply voltage. Applicant respectfully submits that the amendment to the specification does not add new matter.

Claims 1 and 8 have been amended to substitute "voltage reference" for "reference voltage" to ensure proper antecedent basis. Applicant respectfully submits that the amendments to claims 1 and 8 do not add new matter.

Claims 20-22 have been added. Applicant respectfully submits that support for new claims 20-22 may be found in the specification and in claims 1-36 as originally filed.

In particular, applicant respectfully submits that support for new claim 20 can be found in the specification at page 26, lines 4-25; page 23, lines 5-23; and in Figures 1, 7, and 8 of the drawings.

Applicant respectfully submits support for new claim 21 can be found in the specification at page 11, line 12 thru page 18; page 24, lines 14-26; and in Figures 1, 7, and 9 of the drawings.

Applicant respectfully submits support for new claim 22 can be found in the specification at page 11, line 12 thru page 23, line 3; and in Figures 1, 3 and 4 of the drawings.

Applicant respectfully submits that new claims 20-22 do not add new matter.

Applicant respectfully submits the following correspondence between the claims of the present application and the claims of U.S. Patent No. 5,422,832 of Moyal ("Moyal"):

Claim 20 corresponds substantially to claim 1 of Moyal.

Claim 21 corresponds substantially to claim 6 of Moyal.

Claim 22 corresponds substantially to claim 12 of Moyal.

Response to 35 U.S.C. § 103 rejections

Claims 1-19 were rejected under 35 U.S.C. § 103 as being unpatentable over Nelson in view of Giordano and Cacciatore.

Applicant respectfully submits that claims 1-22 are patentable in view of the cited references.

Cacciatore includes a disclosure of an electronic digital thermostat for maintaining a scheduled set ambient temperature. (Cacciatore, col. 2, lines 33-67). The electronic digital thermostat includes a microprocessor and temperature detecting circuit for monitoring *ambient temperature*. (Cacciatore, col. 3, lines 49-65). The microprocessor controls a semiconductor switch in response to a determined temperature difference between an actual *ambient temperature* signal and a dynamically adjusted temperature control signal in order to turn on heating or cooling equipment. (Cacciatore, col. 1, lines 6-17; col. 2, lines 35-39; col. 2, line 61 thru col. 3, line 22; Fig. 1).

Applicant respectfully submits that the temperature detecting circuit of Cacciatore is *external* to the microprocessor so that it can be used to measure *ambient temperature*. (Cacciatore, Fig. 1 element 32). Furthermore, Cacciatore states "The thermistor 174 has a resistance value that varies in relation to the ambient temperature." (Cacciatore, col. 7, lines 29-35). Thus Cacciatore teaches measurement of the ambient temperature, *not the temperature of an integrated circuit or a microprocessor*. Given that Cacciatore teaches regulating the *ambient temperature* applicant submits that Cacciatore teaches away from incorporating the temperature detecting circuit into any structure that would affect measurement of the ambient temperature including an integrated circuit such as a microprocessor. Thus

applicant submit that combination of Cacciatore with the other references is an impermissible use of hindsight.

Giordano includes a disclosure of a thermal sensor circuit. The thermal sensor circuit of Giordano generates a signal when a predetermined threshold temperature is reached. In particular, Giordano discloses a means of varying a temperature sensitive VBE to vary the rate of change of conduction of a transistor for small temperature variations about a critical temperature. (Giordano, col. 5, line 33 thru col. 6, line 4). Applicant submits that the critical temperature is established at the time of manufacture through the characteristics of circuit components such as Q1 and R2 (see col. 1, line 26 thru col. 2, line 2 referring to Fig. 1A; Fig. 4; Fig. 2 as a simplified representation of Fig. 4; col. 2, line 46 thru col. 3, line 39). Applicant thus respectfully submits that *the thermal sensor circuit of Giordano is not programmable.*

Nelson includes a disclosure of a voltage reference circuit including a Brokaw Cell band-gap reference circuit. The voltage reference circuit includes breakpoint compensation to adjust the temperature coefficient of the Brokaw cell in order to provide a reference voltage substantially independent of temperature. (Nelson, col. 2, lines 19-26 and 52-65; Figs. 3-5). Nelson further discloses a thermal shutdown circuit for the voltage reference circuit as incorporated in a voltage regulator. (Nelson, col. 6, lines 46-55; Fig. 4). A driver circuit limits the power output of the voltage regulator. The thermal shutdown circuitry is coupled to the voltage regulator to control the driver circuit to limit the power output of the voltage regulator when a predetermined temperature is exceeded. (Nelson, col. 7, lines 1-19). The predetermined temperature is established by the fixed value of the components of the Nelson circuitry. (see Nelson, Fig 4.; col. 6, line 39 thru col. 7, line 26).

Applicant respectfully submits that *Nelson's temperature independent output voltage is not programmable.* Applicant further respectfully submits that *Nelson's thermal shutdown circuitry is also not programmable.*

Applicant respectfully submits that in order to establish a prima facie case of obviousness three basic criteria must be met. 1) There must be some suggestion or motivation either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings; 2) There must be reasonable expectation of success; and 3) The prior art reference (or references) when combined must teach or suggest all of the claim limitations. Furthermore, the teaching or suggestion to make the claimed combination and the reasonable expectation of success *must be found in the prior art, not in applicant's disclosure*. (MPEP § 2143 citing In re Vaeck, 20 USPQ2d 1438 (Fed. Cir. 1991).

Applicant respectfully submits that given Cacciatore is drawn to detecting ambient temperature, *there is no motivation within any of the cited references to combine Cacciatore with the other cited references as stated above*. Furthermore none of Giordano and Nelson teaches or discloses a method for detecting a threshold temperature in an integrated circuit comprising the steps of 1) receiving at least one programmable input that specifies a threshold temperature for the integrated circuit.

To the contrary, Nelson includes a disclosure of *a nonprogrammable circuit to provide a reference voltage substantially independent of temperature*. The temperature sensor taught by Giordano is *not programmable* as stated above.

In contrast, claim 1 includes the language:

1. A method for detecting a threshold temperature in an integrated circuit comprising the steps of:

• • •
receiving at least one programmable input that specifies a threshold temperature;

• • •

(Claim 1)(*emphasis added*).

Furthermore applicant submits that none of the references, alone or combined, teaches or discloses a method for detecting a threshold temperature in an integrated circuit comprising the steps of 1) generating a scale factor based on the programmable input, 2) scaling a sensing voltage based on the scale factor to generate a comparison voltage, 3) comparing a reference voltage to the comparison voltage, and 4) generating a signal

when the comparison voltage exceeds the reference voltage to indicate the integrated circuit attained the threshold temperature.

In contrast, claim 1 includes the language:

1. A method for detecting a threshold temperature in an integrated circuit comprising the steps of:

• • •

generating a voltage reference that is substantially constant over a range of temperatures of said integrated circuit;

receiving at least one programmable input that specifies a threshold temperature for said integrated circuit;

generating a sensing voltage wherein said sensing voltage amplitude exhibits a substantially linear relationship with said temperature of said integrated circuit;

generating a scale factor based on said programmable input;

scaling said sensing voltage based on said scale factor to

generate a comparison voltage such that when said integrated circuit attains said threshold temperature said comparison voltage is substantially equal to said voltage reference;

comparing said reference voltage to said comparison voltage;

and

generating a signal when said comparison voltage exceeds said voltage reference to indicate said integrated circuit temperature attained said threshold temperature.

(Claim 1)(*emphasis added*).

Thus applicant respectfully submits that claim 1 is patentable under 35 U.S.C. § 103 in view of the cited references.

Given that claims 2-7 depend from claim 1, applicant respectfully submits that claims 2-7 are likewise patentable under 35 U.S.C. § 103 in view of the cited references.

With respect to claim 8, applicant respectfully submits that *none* of the references, alone or combined, teaches or discloses an apparatus for detecting a threshold temperature in an integrated circuit including 1) a programmable input for receiving a threshold temperature; and 2) scaling means in the integrated circuit for generating a scale factor based on a programmable input and scaling a sensing voltage in accordance with the scale factor.

In contrast, claim 8 includes the language:

8. *An apparatus for detecting a threshold temperature in an integrated circuit comprising:*

• • •

at least one programmable input for receiving a threshold temperature for said integrated circuit;

temperature sensing means for generating a sensing voltage wherein said sensing voltage amplitude exhibits a substantially linear

relationship with said temperature of said integrated circuit, said temperature sensing means including *scaling means generating a scale factor based on said programmable input and for scaling said sensing voltage in accordance with said scale factor to generate a comparison voltage such that when said integrated circuit attains said threshold temperature said comparison voltage is substantially equal to said voltage reference; and*

• • •

(Claim 8)(*emphasis added*).

Thus applicant respectfully submits that claim 8 is patentable under 35 U.S.C. § 103 in view of the cited references.

Given that claims 9-14 depend from claim 8, applicant respectfully submits that claims 9-14 are likewise patentable under 35 U.S.C. § 103 in view of the cited references.

With respect to claims 15-19, applicant submits that claim 15 includes the language:

15. *An apparatus for detecting a threshold temperature in an integrated circuit comprising:*

• • •

at least one programmable input that receives a threshold temperature for said integrated circuit;

• • •

(Claim 15)(*emphasis added*).

Applicant submits that claim 15 further includes the language:

15. *An apparatus for detecting a threshold temperature in an integrated circuit comprising:*

• • •

a bipolar transistor wherein a base to emitter voltage (V_{be}) from said bipolar transistor generates a temperature sensing voltage of said integrated circuit;

a voltage divider circuit coupled to said bipolar transistor that scales said V_{be} to generate a comparison voltage such that when said integrated circuit attains said threshold temperature, said comparison voltage is substantially equal to said silicon bandgap voltage; and

a comparator coupled to said collector of said bipolar transistor and to said voltage reference circuit that compares said silicon bandgap voltage to said comparison voltage, and that generates a signal when said comparison voltage exceeds said silicon bandgap voltage to indicate said integrated circuit temperature attained said threshold temperature.

(Claim 15)(*emphasis added*).

Therefore applicant respectfully submits that claim 15 is patentable under 35 U.S.C. § 103 for the reasons similar to those presented above with respect to claim 1.

Given that claims 16-19 depend from claim 15, applicant respectfully submits that claims 16-19 are likewise patentable under 35 U.S.C. § 103 in view of the cited references.

With respect to new claims 20 and 22, applicant submits that claims 20 and 22 include the language:

20. An integrated circuit microprocessor on a semiconductor die, comprising:
a *programmable thermal sensor* providing a temperature signal corresponding to a temperature within the microprocessor, the semiconductor die having a first area and a second area, the first area having a higher temperature than the second area, the thermal sensor positioned proximate the first area; and
sense circuitry coupled to provide an output signal in response to the temperature signal, the sense circuitry providing the output signal when the temperature signal is in a predetermined relationship with a reference signal.

(Claim 20)(*emphasis added*).

22. An integrated circuit apparatus for providing a control signal in response to a temperature of the integrated circuit, comprising:
a current source providing a current;
a voltage reference circuit coupled to the current source to provide a reference voltage, the voltage reference circuit cooperating with the current source to maintain the reference voltage substantially independent of the temperature;
a thermal sensor coupled to the current source to provide a temperature signal in accordance with a *programmable impedance*, the temperature signal corresponding to the temperature;
a sense circuit coupled to receive the reference voltage and the temperature signal, the sense circuit providing the control signal when the temperature signal exceeds the reference voltage.

(Claim 22)(*emphasis added*).

As stated above, applicant respectfully submits that none of Nelson and Giordano teaches or discloses a programmable thermal sensor or programmable impedance. Applicant thus respectfully submits that new claims 20 and 22 are patentable under 35 U.S.C. § 103 in view of the cited references.

With respect to new claim 21, applicant submits that neither Giordano nor Nelson teaches or discloses integrated circuit temperature indicating apparatus comprising a register that stores a value corresponding to a threshold temperature.

To the contrary, neither Giordano nor Nelson discloses a register. The temperature sensor of Giordano and the reference voltage generator of Nelson use nonprogrammable, fixed-value components.

In contrast, new claim 21 includes the language:

21. An apparatus for providing an indicator signal in response to a temperature of an integrated circuit, the apparatus being integrated within the integrated circuit and comprising:

a register that stores a value corresponding to a threshold temperature;

a thermal sensor that generates a temperature signal related to the temperature in accordance with the value;

a sense circuit coupled to the thermal sensor, the sense circuit providing the indicator signal when the temperature signal indicates that the temperature exceeds the threshold temperature.

(Claim 21)(*emphasis added*).

Conclusion

Applicant respectfully submits that in view of the amendments and arguments set forth herein, the applicable rejections and objections have been overcome. Accordingly, claims 1-22, as amended, should be found to be in condition for allowance.

If a telephone conversation would facilitate resolving any outstanding issues, the Examiner is invited to contact the undersigned at (503) 684-6200.

If there are any additional charges associated with this communication, please charge Deposit Account No. 02-2666.

Respectfully submitted,

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Date June 6, 1996

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